V Semester Syllabi – Fire Technology

Sr. No	Course Code	Course Name	L	T	P	Credits
1	FT3CO13	Fire Prevention & Protection System	3	1	0	4
2	FT3CO14	Fire Engineering-I	3	1	2	5
3	FT3CO15	Occupational Health & Hygiene System	3	0	2	4
4		Program Elective V-1	3	0	0	3
5		Program Elective V-2	3	0	0	3
6	FT3CO16	Fire Fighting & Field Training III	0	0	2	1
7	EN3MC02	Technical English	2	0	0	0
8	EN3MC04	Human Values & Ethics	2	0	0	0
9		Open Elective - V-1	3	0	0	3
		Total	**22**	**2**	**6**	**23**
		Total Contact Hours	**30**			

Program Electives

FT3EL03	Fire Works Safety
FT3EL06	Measurement & Instrumentation
FT3EL11	Safety in Petroleum & Petrochemical Industries

Open Electives

OE00001	Stastistical Signal Processing
OE00002	Neural Networks and Fuzzy Systems
OE00003	Industrial Electronics
OE00004	Electronics Engineering Materials
OE00005	Digital Electronics
OE00006	Basics of Enterpreneurship
OE00007	Mechanical Estimation and Costing
OE00008	Fundamentals of Service Markting
OE00013	Photovotaic System

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO13	Fire Prevention & Protection System	3	1	0	4

UNIT I

General Principles of Fire Prevention and Protection Measures: Planning and Construction of the Building: Site Planning considering the nature of the plant, building, equipment and processes from the standpoint of safety and fire protection, where corrosive, poisonous, explosive and easily combustible materials are handled and processed. Type of construction fire walls, barricades etc. Fire separation, fire steps, segregation, isolation.

UNIT II

Internal Planning and Combustion of Plants and Buildings: Layout of hazardous pipe lines, vessels and equipment, planning of strategic points and selection of fire extinguishing device, Automatic, fire doors, fire, doors, wire glass windows, fire walls, parapeted to prevent spread of Fire through roofs, vertical cut offs, Exits, Guards and Guarding, floor platforms, path roadways, stairs, ventilation. Protection and devices for fire due to lightening.

UNIT III

Water Supply and System: Installations using water:
1. Sprinklers 2. Drenchers, 3. Water spray projector systems 4. Rising mains wet and dry.

UNIT IV

Lighting: Lighting arrangement and minimum light required in domestic, commercial, Industrial and public assembly occupancies etc. Emergency lighting systems. Fire Protection Arrangement: Fire appliances; Fire Warning system (Manual and Automatic) fixed fire fighting installations: I. Foam System; II. Gas/ Vapor System, III. Dry Powder System; Special Safety Protection Equipment-Explosion detection, venting and suppression system, Inergen clean agent system and F.M. 200.

UNIT V

Safety and Fire Protection Organization:(a) House -Keeping and management; (b) Plant Fire Brigade and fire -fighting facilities, petrol, systems. Detailed analysis of fire case studies, especially those fires where large number of people have been involved. Interaction and relative value of the components of escape route design, especially smoke movement and control.

Text Books

1. Fire Prevention Hand Book, Kesteren Fire Brigade
2. Fire Prevention Standard Recommendations, Earnest Beam Ltd.
3. Hand Book of Fire Protection by N.F.P.A.

References Books

1. Fire Protection in Factory Buildings by H.M.S.O.
2. Adam and Charles Black, Fire Safety in Building.
3. William K. Bare, Introduction to Fire Science and Fire Protection.
4.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO14	Fire Engineering-I	3	1	2	5

UNIT I

Introduction -Chemistry of fire - Combustion - Composition of Combustion - Flame, heat, fire gases, smoke - Dimensions, Structure, Intensity and velocity of flames. Heat transfer from flames-Ignition temperature -LFL-UFL-Flash Point Fire point-spontaneous combustion-Flash over. Dust explosion classification, of fires. Flammability principles. Ignition. Rate of burning.

UNIT II

Fire hazards-health-flammability -reactivity (stability) Air contaminants generally found in fires-toxic effects of fire gases. Electrical fires, causes, protective system prevention of failure, fire prevention measures,

UNIT III

Fire prevention-handling and storing flammable and combustible liquids. Elimination of ignition sources. Grounding and bonding. Fire protection in plants and factories. Fire walls, fire doors, and means of egress.

UNIT IV

Fire detection-smoke detection-types of ionisation-photo electric-light intensity-scattered light detectors. Heat detectors-Fixed temperature detector -rate of rise detectors pneumatic detectors. Flame detectors -infra red detector - ultra violet flame detector.

UNIT V

Fire suppression. Fixed automatic sprinklers. Sprinkler system-sprinkler design -water supply. Wet system-Dry System-Fixed manual application-sprinkler alarm stand pipes. Portable fire extinguishers-Types-extinguisher location Inspection - testing.

Text Books

1. Fire Prevention Hand Book by Kesteren Fire Brigade
2. Fire Prevention Standard Recommendations by Earnest Beam Ltd.
3. Warre J. Baker, Automation A challenge to Fire Protection Engineers.

Reference Books

1. Fire Protection –Technical Information and Useful General Knowledge by Hand Book of Fire Protection by N.F.P.A.
2. Fire Protection in Factory Buildings by H.M.S.O.

List of Practicals

1. Determination of amount of gases released after combustion (Combustion Calculations)
2. To study the major component of hydrant system on the basis of discharge rate, pressure requirement & percentage of piping.
3. The study of Water distribution network.
4. The study of classification of fire.
5. Determination of various gases present in the atmospheric air.

6. To Study:
   a. Water Type Extinguisher b. Mechanical Foam Type Extinguisher
   c. CO_2 Type Extinguisher d. DCP Type Extinguisher
7. On the basis of working principle, IS Code, mode of Operation & Maintenance of different types of Fire Extinguishers.
8. To study the general requirement of different type of occupancy.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO15	Occupational Health & Hygiene System	3	0	2	4

UNIT I

Recognition, Evaluation and Control of Physical Hazards- Noise and Vibration - Effects and Control Measures- Thermal Stress - Parameter Control, Radiation - Types - Source - Effect and Control- Illumination & Lighting. Recognition, Evaluation and Control of Chemical Hazards- Types - Dust-Fumes -Mist -Vapour-Fog etc., Air Contaminants- Evaluation Types of Sampling-Air Sampling System-Method Analysis-Control Measures

UNIT II

Concept and Spectrum of Health-Functional Units and Activities of Occupational Health Services-Occupational and Work-Related Disease-Levels of Prevention of Diseases-Notifiable Occupational Diseases such as Silicosis- Asbestosis -Pneumoconiosis--Aluminosis and Anthrax. Lead-Nickel, Chromium and Manganese Toxicity-Gas Poisoning (such as CO, Ammonia, Coal Dust etc.,) their effects and Prevention -Cardio Pulmonary Resuscitation Audiology-Hearing Conservation Programme-Effects of Ultra Violet Radiation and Infrared Radiation on Human Systems.

UNIT III

Industrial Toxicology-Local and Systemic and Chronic Effects Temporary and Cumulative Effects-Carcinogens Entry into Human System Ergonomics, Personnel Protective Equipment, Personnel Monitoring.

UNIT IV

Hygiene Concepts-Correct and Clean Dresses-Clean Body - Washing - Good Habits-Oral and Stomach Hygiene-Cleaning - Compressed Air and Degreasing Agents-Long Hair and Nails and Torn and loosely Hanging Clothes-Smoking - Lavatories Maintenance- Living in Unhygienic Areas.

UNIT V

First aid concept- -First Aid Boxes-Legal Requirements, Industrial Hygiene, Medical Surveillance, Medical Surveillance Program Development, Recommended Medical Programme, Emergency Treatment, Non-Emergency Treatment, Exposures to Hazardous Materials.

Text Books

1. A. Barbara, J. Quinlan, Fundamentals of Industrial Hygiene, MPH CIH Editor
2. John Ridley & John Channing, Safety at work, MIMechE FIOSH DMS (Editor)
3. K U Mistry,Fundamentals of Industrial Saferty and Health, Siddharth Prakashan.

Reference Books

1. Hunter's Diseases of occupation, CRC Press
2. Code of Practice for Hazardous goods by NFPA
3. S. Irvin, Dangerous properties of Industrial materials, Van Nostrand Reinhold

List of Practicals

Sampling of air monitoring

1. Study of gas detection system
2. Study of chlorine detection & control measures
3. Study of ammonia detection & control measures
4. Study of portable gas monitoring equipments
5. Study of flammable gas detection monitor
6. Study of dust monitoring System

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3EL03	Fire Works Safety	3	0	0	3

UNIT I

Properties Of Fireworks Chemicals : Fire properties potassium nitrate (KN03), potassium chlorate (KCl03), barium nitrate (BaNO3), calcium nitrate (CaNO3), Sulphur (S), Phosphorous (P), Antimony (Sb), Pyro Aluminum (A1) powder Reactions metal powders, Borax, ammonia (NH3) Strontium Nitrate, Sodium Nitrate, Potassium per chloride. Fire and explosion, impact and friction sensitivity.

UNIT II

Static Charge And Dust: Concept prevention earthing copper plates dress materials static charge meter lightning, Causes effects hazards in fire works factories lightning arrestor :concept installation earth pit maintenance resistance legal requirements case studies. Dust: size desirable Non respirable biological barriers hazards personal protective equipment pollution prevention.

UNIT III

Process Safety : Safe quantity, mixing filling fuse cutting fuse fixing finishing drying at various stages packing storage hand tools materials, layout: building distances factories act explosive act and rules fire prevention and control risk related fireworks industries.

UNIT IV

Material Handling :Manual handling wheel barrows trucks bullock carts cycles automobiles fuse handling paper caps handling nitric acid handling in snake eggs manufacture handling the mix in this factory material movement godown waste pit.
TRANSPORTATION: Packing magazine design of vehicles for explosive transports loading into automobiles transport restrictions case studies overhead power lines driver habits intermediate parking fire extinguishers loose chemicals handling and transport.

UNIT V

Waste Control And User Safety: Concepts of wastes, wastes in fireworks Disposal Spillages storage of residues. Consumer anxiety hazards in display methods in other countries fires, burns and scalds sales outlets restrictions role of fire service.

Text Books

1. K.N.Ghosh, "Principles of fireworks", H.Khatsuria, Sivakasi, 1987.
2. "Proceedings of National seminar on Fireworks Safety -1999", MSEC-1999.

References Books

1. "Seminar on explosives", Dept.of of explosives.
2. J.A.Purkiss, "Fireworks Fire Safety Engineering"
3. Bill of once , "Fireworks Safety manual"
4. "Goeff, "Dust Explosion prevention, Part 1"
5. A.Chelladurai, "Fireworks related accidents"
6. A.Chelladurai, "Fireworks principles and practice"
7. A.Chelladurai, "History of the fireworks in India" Brock, "History of fireworks"

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3EL06	Measurement & Instrumentation	3	0	0	3

UNIT I

General concepts of measurement: Definition, Standards of measurement, Errors in measurement, various systems of limits, fits and tolerance, ISI and ISO, Calibration: Static calibration, dynamic calibration, static sensitivity, range, accuracy and precision, Introduction to uncertainty, zero order, first order, and second order system.

Strain Measurement: Stress and strain, resistance strain gauges, gauge factor, strain gauge electrical circuits and multiple gauge bridge.

UNIT II

Force Measurement: Displacement measurement, Potentiometers, Linear variable differential transformers (LVDT), rotary variable differential transformer (RVDT)

Torque measurement: Measurement of torque on rotating shafts.

Vibration measurements: Working principle of Vibrometer and accelerometer, Frequency measurement.

UNIT III

Temperature Measurement: Measurement of temperature, liquid in glass thermometer, resistance thermometers – constructional details, resistance thermometer circuits, laws of thermocouples, pyrometers.

Pressure Measurement: Standards of pressure measurement, measurement of high pressure, measurement of low pressure – The McLeod Gauge.

Flow measurement: Pressure differential meters: Orifice meter, Venturi meter.

UNIT IV

Linear and Angular Measurements: Slip gauges, micrometres, vernier callipers, dial gauges, surface plates, comparators- mechanical, angular measuring instruments- sine bar, angle gauges, spirit level, autocollimators.

Measurement of surface finish: Surface finish- definition, terminology, types of surface texture, surface roughness measurement methods, comparison, profile-meters.

Metrology of screw threads and gears: Internal/external screw threads, terminology, measurement of various elements of threads, thread micrometre method, **Gears** : terminology, measurement of various elements, constant chord method, base tangent method.

CMM – Types, constructions and measurements.

UNIT V

Transducers and data acquisition systems: Classification of transducers, selection of transducers, resistive, capacitive & inductive transducers, piezoelectric, optical and digital transducers, Elements of data acquisition system – Analog to digital (A/D) and Digital to analog (D/A) converters, Smart sensors.

Electrical and electronics instruments: Principle and types of analog and digital voltmeters, ammeters, multi-meters, Single and three phase wattmeter's and energy meters, Magnetic measurements, Determination of B-H curve and measurements of iron loss – Instrument transformers, Instruments for measurement of frequency and phase.

Text Books

1. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria &Sons
2. R. K. Jain, Engineering Metrology, Khanna Publishers, New Delhi.
3. R.K.Rajput,Mechanical Measurement and Instrumentation, Katson Books.
4. C. Sujatha, Vibration and Acoustics, Tata McGraw Hill.

Reference Books

1. I.C. Gupta, Engineering Metrology, Danpat Rai Publications.
2. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill.
3. B. C. Nakra, K. K. Chaudhry , Instrumentation, Measurement And Analysis, Tata McGraw Hill.
4. Robert J. Hocken, Paulo H. Pereira, Coordinate Measuring Machines and Systems, CRC Press.

Course Code	Course Name	Hours per Week			Total Credits
		L	T	P	
FT3EL11	Safety in Petroleum & Petrochemical Industries	3	0	0	3

UNIT I

Crude oil, its properties & Characteristics, Classification of petroleum & its products, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Nature l Gas, nylon, Naphtha, Ammonia, Benzene, toluene, Acetylene.

UNIT II

Refining Processes: - Primary Distillation, catalytic cracker, polymerization, reforming, steam cracking, sulphur recovery, Lubricating oil treating. Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Layout of Refineries - simplified flow diagram of a typical refinery.

UNIT III

Fire protection & emergency planning:- Major fire risks, design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & steam snuffing systems. Storage tanks protection. Use of various media in petroleum & gas fires such as water, foam, DCP.

UNIT IV

Fighting refinery & petrochemical fires: - Potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Fire fighting facilities for depots, terminals, on-shore, off-shore drilling platforms, and pipelines for transportation of petroleum products & Gas. Fighting Gas terminal fires: - Fire fighting & procedures in case of BLEVE, LPG hazards, spillage, vehicles using LPG & CNG as a fuel. Fire fighting facilities at LPG bottling plants. Water Injection into LPG vessel (water bottoming)

UNIT V

Statutory provisions pertaining to refineries, petrochemical plants & gas terminals: - Oil Industry Safety Directorate (OISD), Petroleum Act 1934, Petroleum Rules 2002, Petroleum & Natural Gas Regulatory Board (PNGRB) drafts, Explosive Act 1884, Explosive Rules 1983 and Gas cylinders Rules 2004. Application of advance technologies used in refineries & petrochemical pla Application of advance technologies used in refineries & petrochemical plants such as SCADA, SAP and various simulation molding.

Text Books

1. Fire Service Manual (Volume 2) Fire Service Operations – Petrochemical Incidents
2. Manual of Firemanship, Part 6-A by H.M.S.O.
3. Oil Industry Safety Directorate (OISD) Norms & Rules

References Books

1. Petroleum & Natural Gas Regulatory Board (PNGRB) drafts
2. Petroleum Act 1934
3. Petroleum Rules 2002

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
FT3CO16	Fire Fighting & Field Training III	0	0	2	1

The field training based on the following is to be performed

1. Hose Drills General movements to be noted for handling delivery hose, hydrant Drill (3-Men)
2. Hydrant Drill (4-Men).
3. Pump Drills Trailer Pump Drill (Four Men), Trailer Pump Drill (Six Men), Motor Fire Engine
4. (without escape)/Water Tender Drill (Six Men), First Aid Hose reel Drill (Three Men).
5. Ladder Drills: Extension Ladder (Four Men), Hook Ladder Drill, Hook Ladder Drill (One Men),
6. Hook Ladder Drill (Two Men), Hook Ladder Drill (Three Men), Fire escape Ladder Drill (Six
7. Men), getting a Branch to work up on Escape Ladder, getting a Branch to work from an escape
8. Ladder, Turn Table, Ladder Drill (Six Men), Hydraulic Platform. Drill (Six Men).
9. Foam Drill (F.B.-2) Foam Drill with inline inductor (Six Men)

The field training based on the following should be given

1. Rescue Drill
2. Rescue from fire.
3. Rescue from the accidents (Road side, railway accident & Aircraft),
4. Rescue from electrocution and
5. Rescues from well.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3MC02	Technical English	2	0	0	0

UNIT I

Higher grammar and Vocabulary-Idioms and phrases, Antonyms and Synonyms. Modals, Narration, Voices, Clauses,

UNIT II

Reading Skills-Three –Pass system, Comprehending passage.

UNIT III

Writing skills- Precis writing, Story writing, Report writing, Paragraph writing, Unseen prose, Letter writing, Interpretation of charts, Translation- from Indian to English and vice-versa, Writing speeches, Paraphrasing
Citing resources- Editing book and Media Review

UNIT IV

Speaking Skills- Critical Thinking: syntheses, analysis and evaluation, Oral presentation, Importance of Audio-Visual aids, Speeches, Jam.

UNIT V

Soft Skills- Team Work, Emotional Intelligence, Adaptability, Leadership and problem solving.

Text books

1. S C Sharma and Krishna Mohan Business Correspondance and Report Writing a: a practical approach to business and technical communication, TMH
2. A J Thomson& A V Martinet, A Prcatical English Grammar Fourth Edition, Oxford University Press New Delhi India.
3. Kalex, Soft Skills: Know yourself and know the world, S Chand & Company Ltd. New Delhi.

Reference Books

1. L Bovee Courtland, John V Thill and Mukesh Chaturvedi Business Communication Today Dorling Kindersley (India) Pvt. Ltd.
2. Ranjan Bhanu, Communication Skills, Dhanpat Rai & Co. (Pvt) Ltd Delhi.
3. P. C. Wren; H. Martin, High School English Grammar & Composition, S Chand & Company Ltd

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3MC04	Human Values & ethics	2	0	0	0

UNIT I

Human Values: Introduction, Important Human Values: Trust, Honesty, forms of Dishonesty, Courage, Integrity, Kindness, Humility, Gratitude, Hope, Perseverance, Empathy and Compassion.

Values in Engineering Profession: Safety, Risk, Accidents, Human progress; Clean, Clear, Decision Making; Community, Partnership with Nature. Commitment and Cooperation.

UNIT II

Ethics and Ethical Theories: Morality and moral systems, Introduction to Ethics, Consequentiality and Non-consequentiality theories, Hedonism, Utilitarianism, Deontological theories, Ethical Rules (with reference to W D Ross), Situation Ethics, Virtue Ethics

UNIT III

Ethics in Engineering Profession: Introduction, Historical context of ethics, Definition of Profession, Engineering and Professionalism, Professional Ethics, Engineering Ethics, Role and Responsibilities of Engineers, Working towards Safety, Sample Code of Ethics for Engineers, National Society of Professional Engineers (NSPE).

Practicing ethics as an engineering student: Plagiarism & Cheating, Academic Dishonesty and Cheating v/s Teamwork.

UNIT IV

Decisions Making: Decision Making, Characteristics of Decision Making, Advantages of Decision Making, Steps Involved in Decision Making Process.

UNIT V

Ethics In The Indian Tradition And Some Case Studies: Contribution of Moral Thinkers:Indian Moral Thinker, Western Moral Thinker. Case studies on human values and engineering ethics. Case studies on decision making in engineering ethics.

Text Books

1. Simon Blackburn, The Oxford dictionary of philosophy. Oxford University Press.
2. Anthony Weston, A 21st Century Ethical Toolbox. Oxford University Press.
3. John Hospers, An introduction to philosophical analysis. Allied Publishers Private Limited.

Reference Books

1. W.K Frankena, Ethics. PHI.
2. John Hospers, An Introduction to Philosophical Analysis. Allie Publishers.
3. LaFollette Hugh, Ethics in Practice: An Anthology. Cambridge, Blackwell.

Web Sources

1. http://ethics.sandiego.edu/
2. http://www.bbc.co.uk/ethics/introduction/
3. http://plato.stanford.edu/

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3MC04	Human Values & ethics	2	0	0	0

UNIT I

Human Values: Introduction, Important Human Values: Trust, Honesty, forms of Dishonesty, Courage, Integrity, Kindness, Humility, Gratitude, Hope, Perseverance, Empathy and Compassion.

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Web Sources

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